CHEMICAL AGENTS/COMPOUNDS

Subcourse Number CM3404

EDITION A

United States Army Chemical School
Fort Leonard Wood, Missouri 65473-8926

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SUBCOURSE OVERVIEW

This subcourse is designed to teach you the fundamental aspects of chemical agents. You will learn the terminology of chemical agents, their properties, classification, uses, detection methods, defense, duration of effectiveness and decontamination. The description of lethal, incapacitating and miscellaneous chemical agents is presented.

There are no prerequisites for this subcourse.

The subcourse is presented in two lessons which reflect the doctrine which was current at the time it was prepared. In your own work situation, always refer to the latest official publications.

Unless otherwise stated, the masculine gender of singular pronouns is used to refer to both men and women.

TERMINAL LEARNING OBJECTIVE

ACTION:	Describe the aspects of chemical agents and compounds.
CONDITION:	Given information and illustrations about chemical agent terms, classification, properties, duration of effectiveness, and markings for chemical munitions.
STANDARD:	To demonstrate competency of this task, you must achieve a minimum of 70% on the subcourse examination.

In this subcourse, you will learn the fundamental aspects of chemical agents. In order to understand the fundamental aspects of chemical agents, you must be able to:

1. Explain terms used in describing chemical agents.
2. Describe requirements for chemical agents.
3. Describe markings on chemical munitions.

Once you have learned the fundamental aspects of chemical agents, you will learn about lethal, incapacitating, and miscellaneous chemical agents. In order to understand lethal, incapacitating, and miscellaneous agents, you must be able to:

1. Describe nerve and blister agents.
2. Describe blood and choking agents.
3. Describe miscellaneous and incapicitating agents.

The information you will receive in this subcourse will help you understand chemical agents and compounds, their capabilities and limitations.

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LESSON 1

FUNDAMENTAL ASPECTS OF CHEMICAL AGENTS

Critical Task: 031-506-2002

OVERVIEW

LESSON DESCRIPTION:

In this lesson you will learn the description of fundamental aspects of chemical agents.

TERMINAL LEARNING OBJECTIVE:

ACTION:	Describe fundamental aspects of chemical agents.
CONDITION:	Given information and illustrations about chemical agent terms, properties, classification, duration of effectiveness, and markings for chemical munitions.
STANDARD:	Demonstrate competency of the task skills and knowledge by responding to the multiple-choice test covering chemical agent terms, properties, classification, duration of effectiveness, and markings for chemical munitions.
REFERENCES:	FM 3-6, FM 3-8, FM 3-9, FM 3-10 and STP 3-54B2-SM.

INTRODUCTION

An aggressor's perception of United States unpreparedness for chemical warfare may lead to testing this perception in combat. If this occurs, the skills and dedication of soldiers, staffs, and commanders will be severely tried by an enemy possessing an overwhelming numerical superiority. Chemical agents may be employed by any force to develop additional combat power. Chemical agents may, if properly employed, do much toward neutralizing any numerical advantage the enemy may have, reduce the effectiveness of combat formations, disrupt rear area operations and troop movements, restrict the use of key terrain and reduce the combat efficiency of troops. Chemical agents give commanders options that vary from mild incapacitation, lasting a few hours, to serious illness and injury requiring months of treatment and convalescence, or death. These effects, depending upon the agent selected, may be produced immediately, in a few minutes to an hour, or they may be delayed for several hours. At the same time, chemical agents may be used in combination with other agents or with conventional weapons, disguising and/or complementing the effects of one or both systems.

PART A - CHEMICAL AGENT TERMS

As a prerequisite for understanding chemical agents, you must have a working knowledge of the terms used in describing chemical agents. The more commonly used terms are explained as they apply to military chemistry and chemical agents. The following is a good reference to enhance understanding of the terms used in the subcourse.

1. **Aerosol.** A liquid or solid, composed of finely divided particles, suspended in a gaseous medium. Examples of common aerosols are mist, fog, and smoke.

2. **Atropine.** An alkaloid obtained from Atropa Belladonna. It is used as an antidote for nerve agent poisoning. It inhibits the action of acetylcholine at the muscle junction.

3. **Chemical Agent.** A chemical compound which, through its chemical properties, produces lethal or damaging effects on man. Excluded from consideration are riot control agents, chemical herbicides, and smoke and flame materials.

4. **Chemical Agent Casualty.** A person who has been affected sufficiently by a chemical agent to prevent or seriously degrade the ability to carry out the mission.

5. **Chemical Agent Symbol.** The US Army code designation of any chemical agent. This is a combination of one to three letters or letter/number combinations; it should not be confused with the chemical formula.

6. **Chemical Compounds.** Chemical mixtures which are not intended to produce lethal or damaging effects on human beings. Included in this group are riot control agents, herbicides, and smoke and flame materials.

7. **Chemical Contamination.** The presence of a chemical agent on a person, object or area. Contamination density of a chemical agent is usually expressed either in milligrams or grams per square meter (mg/m^2, g/m^2) or in pounds per hectare (lb/ha). A hectare is 10,000 square meters.

8. **Chemical Weapons System.** An integrated relationship of chemical agents, munitions, or spraying devices and their mode of delivery to the target.

9. **Concentration.** The amount of a chemical agent present in a unit volume of air. Usually expressed in milligrams per cubic meter (mg/m^3) of air.

10. **Decontaminating Material.** Any substance used to chemically destroy, physically remove, seal, or otherwise make a chemical agent harmless.

11. **Detection.** The determination of the presence of a chemical agent.

12. **Dosage (Ct).** The concentration of a chemical agent in the atmosphere (C) multiplied by the time (t) the concentration remains, expressed as mg-min/m3 or the cumulative exposure equivalent to the concentration of chemical agents to which and individual is exposed, integrated over the time of exposure. The dosage received by a person depends upon how long the person is exposed to the concentration. That is, the respiratory dosage in mg-min/m^3 is equal to the time in minutes an individual is unmasked in an agent cloud multiplied by the concentration of the cloud. The skin dosage is equal to the time of exposure in minutes of an individual's unprotected skin multiplied by the concentration of the agent cloud. (This is generally understood as being the effect upon the whole body.) The physiological effectiveness of skin and respiratory aerosol dosages are influenced by particle size as well as time and concentration, since retention by the lungs and impingement upon the skin are functions of particle size. They are usually expressed in mg-min/m^3 for a particle size.

13. **Liquid Dosage.** The weight of liquid agent received by a person on the skin is usually expressed as dosage in milligrams of contaminant per kilogram (kg) of body weight (mg/kg). This is equivalent to parts per million.

14. **Restrictions.** Actually, an individual may show signs and symptoms after exposure to a chemical agent which are less or more than expected for a given dosage (Ct), depending upon some of the following variables:

a. How long the breath was held during short exposure.

b. Speed with which mask was donned.

c. Ability to fit mask and mask leakage factors.

d. Whether the chemical agent was also absorbed through the skin.

e. Whether the chemical agent stimulated the rate of breathing.

f. Rate and depth of breathing of the individual at time of exposure.

g. Amount of physical exertion of the individual at time of exposure.

h. Rate of detoxification, especially if exposure was long. For tabulation purposes, such variables are ignored, and the Ct values are assumed to measure the amount of chemical agent received by an individual breathing at a normal rate in a temperature climate with average humidity. These values provide a basis of comparison for the chemical agent.

15. **Harassing Concentration.** A concentration of a chemical agent which requires masking or other protective measures. Such concentrations may be insufficient to kill, but sufficient to interfere with normal operations.

16. **Identification.** Can be subdivided into two levels of identification as follows:

a. Definitive identification is the determination of the exact identity of a compound through the establishment of a group of unique characteristics.

b. Classification is the determination that a compound is a member of a class of substances without knowledge of the exact identity of the compound.

17. **Lethal Chemical Agent.** An agent that may be used effectively in field concentrations to produce death.

18. **Oxime.** 2-PAM Chloride (trade name Protopam Chloride or Pralidoxime Chloride) used in treatment of nerve agent poisoning by some, but not all, cholinesterase inhibitors (nerve agents). Unlike Atropine, it acts by reactivating the inhibited enzyme of the skeletal muscles as well as the parasympathetic (glands and intestinal tract) sites, and therefore relieves the skeletal neuromuscular block which causes the paralysis associated with the nerve agents.

19. **Persistency.** An expression of the duration of effectiveness of a chemical agent. This is dependent on physical and chemical properties of the agent, weather, methods of dissemination, and conditions of terrain. **Persistent** and **Nonpersistent** should not be used to denote classes of chemical agents.

20. **Physostigmine.** An alkaloid from Physostigma venonosum. Physostigmine salicylate is used to relieve symptoms of BZ and other glycollate casualties.

21. **Toxicity.** The property possessed by a material which enables it to injure the physiological mechanism of at organism by chemical means, with the maximum effect being incapacitation or death.

22. **Toxin.** A poisonous product of animal or vegetable cells which, when inhaled, swallowed, or injected into man or animals, will cause illness or death.

23. **Training Agent.** An agent authorized for use in training to enhance proficiency for operating in a chemical environment.

24. **Vesicant Agent.** An agent which acts on the eyes and lungs and blisters the skin.

25. **Warning.** The timely dissemination of the information that a chemical agent is present or anticipated.

26. **Monitoring.** The continued or periodic act of seeking to determine whether a chemical agent is in the area.

27. **Survey.** The directed effort to determine the location and nature of the chemical agent in an area.

28. **On-target Attack.** Chemical agents are delivered directly into the target area where a position is the target for a direct attack by one or more chemical agents delivered either by air or ground means.

29. **Off-target Attack.** Residual chemical agent clouds drift onto positions or where personnel moving across country encounter toxic clouds or surface contamination.

30. **Median Lethal Dosage** (LCt_{50}). The LCt_{50} of a chemical agent is the dosage (vapor concentration of the agent multiplied by the time exposure) that is lethal to 50 percent of exposed unprotected personnel at some given breathing rate. The unit used to express LCt_{50} is mg-min/m^3.

31. **Median Incapacitating Dosage** (ICt_{50}) The ICt_{50} of a chemical agent is the amount of inhale vapor that is sufficient to disable 50 percent of expressed unprotected personnel. The unit to express ICt_{50} is mg-min/m^3.

PART B - CHEMICAL AGENT REQUIREMENTS

A discussion of chemical agents would be incomplete without an understanding of what makes a substance a chemical agent and the features desired in a chemical agent.

1. **Chemical Agent Requirements.** The following are the requirements of a chemical agent:

- It must possess toxicity. Through its chemical properties, it will produce lethal and damaging effects on man, animal or plant.
- It must also be capable of accomplishing the mission for which it is employed.
- It must be stable or capable of being stabilized during the period of time between its production and use.
- It must be procurable from available raw materials in the quantity required for effective military use.

- It must be capable of being disseminated from a device practicable for field use in sufficient concentration to produce the desired effect on the target.
- It must be capable of being handled and transported, provided proper precautions are observed.

2. **Desirable Features.** The following are desirable additional features of a chemical agent:

- It should have little or no corrosive action on the munition or container during storage.
- It should possess such inherent properties that complete protection from the chemical agent is difficult for enemy personnel. If possible, the agent should be capable of minimizing the effectiveness of the protective equipment of potential enemies.
- The agent's mechanism of action, protective measures, and method of treatment should be known.
- It should be difficult to detect by ordinary methods prior to the time of onset of physiological and/or psychological effects. Colorless, odorless, and nonirritating toxic chemical agents are desirable.

3. **Classification.** Once you understand the features of a chemical agent, the next step is classifying chemical agents and miscellaneous related compounds. Chemical agents and chemical compounds are classified according to: **physical state** (including degree of volatility), **use**, and **physiological action**. **Persistent** and **nonpersistent** are terms used to describe the tactical use of chemical agents and should not be used as terms to technically classify them.

a. **Physical State.** Chemical agents and chemical compounds may exist as solids, liquids, or gases. To a certain extent the state in which an agent normally exists determines its use, duration of effectiveness, physiological action, and the type of munition used for its dissemination.

b. **Chemical Agent Use.** Chemical agents may be grouped according to use as follows:

(1) **Toxic Chemical Agents.** Agents capable of producing incapacitation, serious injury, or death when used in field concentrations.

(2) **Incapacitating Agents.** Agents that produce physiological or mental effects, or both that may persist for hours or days after exposure, rendering individuals incapable of concerted effort in the performance of their assigned duties. Complete recovery of incapacitating agent casualties is expected without medical treatment. (See Table 2-1.)

c. **Chemical Compound Use.** Chemical compounds may be grouped according to use as follows:

(1) **Training Agents and Compounds.** Authorized for training.

(2) **Screening and Signaling Smokes.** Screening smokes are compounds that produce an obscuring smoke when burned hydrolyzed, or atomized; they are used to limit observation and to reduce the effectiveness of aimed fire. Signaling smokes are similar to screening smokes, except that signaling smokes generally are colored and are used for visual communication. The standard colors are green, red, violet and yellow.

d. **Physiological Action.** Physiological actions of chemical agents are described below.

(1) **Choking Agents.** Chemical agents causing irritation and inflammation of bronchial tubes and lungs. Their primary physiological action is limited to the respiratory tract, with injury extending to the deepest part of the lungs.

(2) **Nerve Agents.** Chemical agents which, when absorbed into the body by inhalation, ingestion, or through the skin, affect the body functions by reacting with an enzyme (cholinesterase) throughout the body, permitting accumulation of a stimulator (acetylcholine). The major effects are those on the voluntary nervous system, e.g., muscle stimulation with uncoordinated contractions; followed by fatigue and eventual paralysis; those on the parasympathetic nervous system, e.g., pinpointed pupils; bronchial constriction; nausea, vomiting, and diarrhea; secretion of the glands of the nose, mouth, bronchi, and gastrointestinal system; and those on the central nervous system, e.g., disturbances in thought, convulsions, coma, and lethal depression of the vital centers of the brain.

(3) **Blood Agents.** Chemical agents which, when absorbed into the body primarily by breathing, affect body functions through actions on an intracellular enzyme called cytochrome oxidase. This stops normal metabolism in every cell in the body, and the cells are unable to use the oxygen brought to them by the blood. The body tissues are rapidly damaged by this failure to utilize oxygen.

(4) **Vomiting Agents.** Compounds causing vomiting may also cause coughing, sneezing, pain in the nose and throat, nasal discharge, tears, as well as headache often following.

(5) **Blister Agents.** Chemical agents that are readily absorbed by both exterior and interior parts of the body, causing inflammation, blisters, and general destruction of tissues. Besides affecting the skin, the agent vapors attack the respiratory tract with the effects usually more severe in the upper tract. Eyes are very susceptible to blister agents.

(6) **Tear Agents.** Compounds causing a large flow of tears and intense, although temporary, eye pain when used in normal field concentrations. The tear agent CS is very irritating to the respiratory tract mucosa, causing the sensation of difficulty in respiration. In high concentrations, tear compounds are irritating to the skin and cause a temporary burning and itching sensation. High concentrations can also cause burns, nausea, and vomiting.

4. **Duration of Effectiveness of Chemical Agents.** Factors that determine the duration of time a chemical agent exists at the point of dissemination are:

a. **Physical Properties of the Agent.** Volatility is one physical property that is especially important in determining the duration of effectiveness of an agent. Viscosity is another important property.

b. **Weather Conditions.** Temperature, temperature gradient, wind speed, and precipitation are the most important weather factors in determining duration of effectiveness.

c. **Methods of Dissemination.** The state of physical division greatly influences the effectiveness of agents which are normally liquid or solid. In explosive munitions, the degree of division is dependent upon the amount and type of burster charge and upon the fuzing of the munition (air or ground burst). Nonexploding types of munition, such as aerosol generators and spray tanks, are devices for varying the degree of dispersion and thus influencing the duration of effectiveness of chemical agents.

d. **Conditions of Terrain or Target.** Vegetation, soil, and buildings play an important part in the duration of effectiveness of a chemical agent at the point of release.

PART C - CHEMICAL MUNITIONS MARKINGS

1. The hazards of chemical munitions dictate that the user must be able to correctly identify the munition prior to use. There may also be occurrences in which munitions are found and must be identified to determine the existing hazard. To further complicate this, all chemical munitions manufactured prior to January 1961 follow the Five-Element Marking System (Old), while all chemical munitions manufactured after January 1961 are marked using the Standard Color Coding System (New) or the Revised Color Coding System (1976). It is of the utmost importance to understand each system for the following reasons:

- Current stockpiles of chemical and related munitions contain a high percentage of munitions manufactured prior to January 1961, as well as those manufactured since.
- Personnel engaged in operations in former training and range areas may encounter munitions marked using each system.

2. A working knowledge of each system is necessary to correctly identify munitions and therefore determine the associated hazards. The Five-Element Marking System (Old), prior to January 1961, the Standard Color Coding System (New), after January 1961, and the Revised Color Coding System (1976) are described in the following paragraphs.

a. **Five-element Marking System (Old).** All chemical munitions manufactured before January 1961 follow the Five-Element Marking System. According to this system, all chemical munitions are marked with a gray background. One band around the munition indicates a nonpersistent effect agent and two bands indicate a persistent effect agent. Green marking on the gray background signifies toxic chemical agents and red marking signifies irritant agents. A descriptive word such as gas indicates the general nature of the agent. A chemical agent symbol (GB, VX, HD) indicates the exact filling. Additional information on chemical munitions is given in the following technical manuals: TM 9-1901-1, TM 9-1300-202, TM 9-1325-200, and TM 43-0001-26-1. The Five-Element Marking System of marking chemical munitions at the present is shown in Figure 1-1.

b. **Standard Color Coding System (New).** The Standard Color Coding System of marking chemical munitions at the present is shown in Figure 1-2.

c. **Revised Color Coding System (1976).** Munitions manufactured after 1976 are marked according to the Revised Color Coding System (1976) shown in Figure 1-3.

NOTE

All chemical munitions manufactured prior to January 1961 will retain their original color code markings.

3. **Chemical Compounds.** Chemical compounds, to include toxic chemical agents (casualty agents) and incapacitating agents, are indicated by a gray background with appropriate bands to indicate the persistency of the filling. The presence of a high or low explosive charge is indicated by a yellow or brown band, respectively, in addition to the appropriate chemical substance markings.

a. **Toxic Chemical Agents.** Gray background with green bands; one band for nonpersistent agents, two bands for persistent agents, and three for nerve agents.

b. **Incapacitating Agents.** Gray background with red bands; one band for nonpersistent agents and two bands for persistent agents.

FIVE-ELEMENT MARKING SYSTEM (OLD)

BACKGROUND (CML MUNITION)	NO. OF BANDS (DURATION OF EFFECTIVENESS)	COLOR OF MARKINGS [1] (PRIMARY USE)	CHEMICAL AGENT SYMBOL (EXACT FILLING)	DESCRIPTIVE WORD (GENERAL NATURE OF AGENT ON RELEASE)
		TOXIC CHEMICAL AGENTS (CASUALTY AGENTS)	GB, CG, CK	GAS
		TOXIC CHEMICAL AGENTS (CASUALTY AGENTS)	VX, HD, H, HT	GAS
		IRRITANT AGENTS (RIOT CONTROL AGENTS)	CN, CS, CN1, CS1	GAS
		INCENDIARIES	TH, NP, PT1, PTV	INCENDIARY
		SMOKES (SCREENING AND SIGNALING)	HC, WP, PWP	SMOKE

[1] MARKINGS INCLUDE BANDS AND LETTERING

Figure 1-1. Five-Element Marking System (Old)

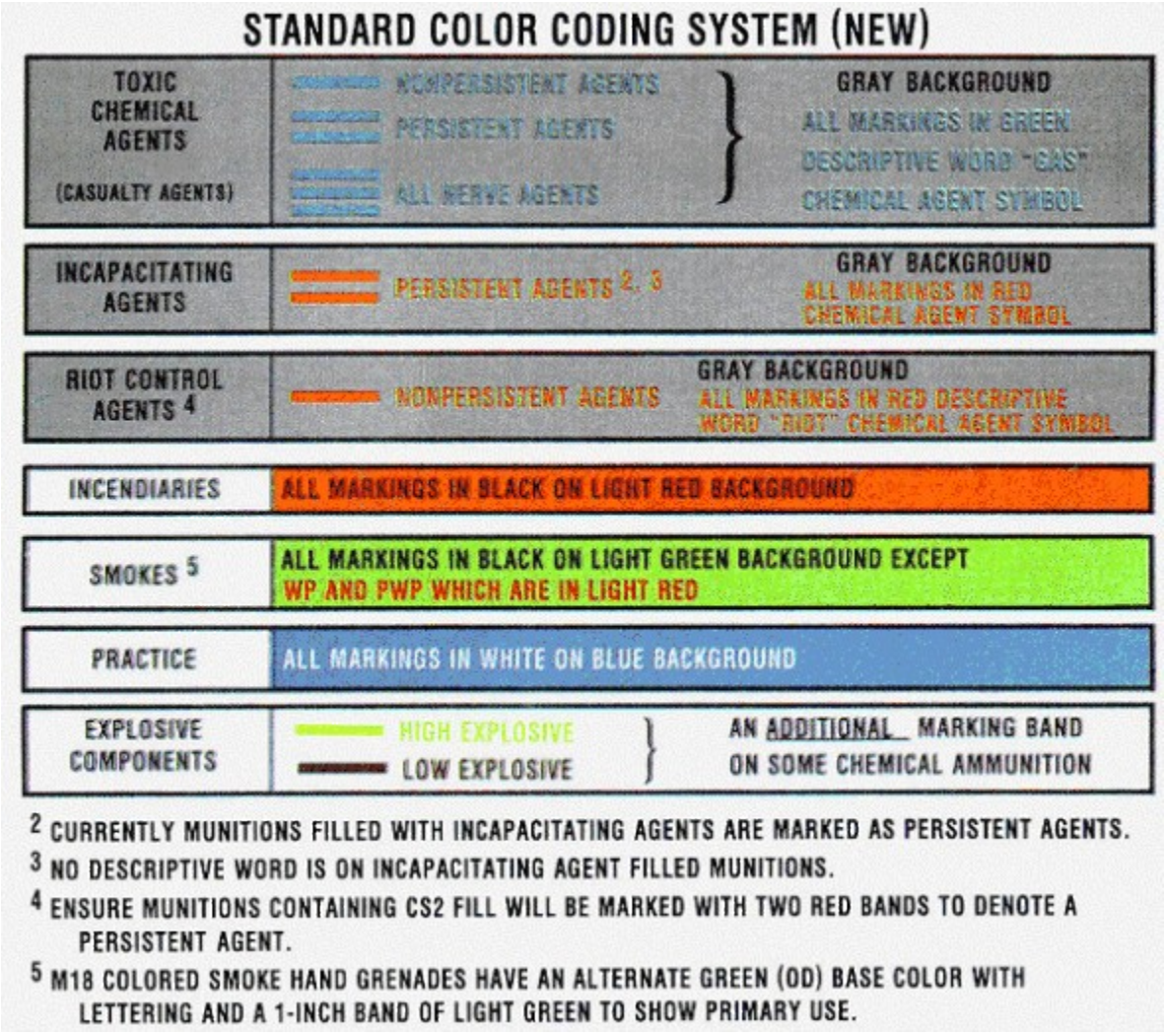

Figure 1-2. Standard Color Coding System (New)

REVISED COLOR CODING SYSTEM (1976)

AGENT/FILLER	MARKING[1]/ BACKGROUND/BAND COLOR	
TOXIC CHEMICAL AGENTS	ALL NERVE, BLISTER, BLOOD, CHOKING AGENTS	
	TOXIC BINARY	
INCAPACITATING AGENTS	B Z	
RIOT CONTROL AGENTS	ALL CS, CN D-SERIES	
INCENDIARY AGENTS [2]	ALL MARKINGS IN BLACK	
SCREENING AND SIGNALING SMOKES [2]	OTHER THAN WP, PWP	
	WP, PWP	
PRACTICE [2]	ALL MARKINGS IN WHITE	
EXPLOSIVE COMPONENTS (ADDITIONAL MARKING BANDS)	HIGH	
	LOW	

[1] MARKINGS INCLUDE NAME OR CHEMICAL AGENT SYMBOL

[2] NO BAND INCLUDED

Figure 1-3. Revised Color Coding System (1976)

LESSON 1
PRACTICE EXERCISE

Instructions The following items will test your understanding of the material covered in this lesson. There is only one correct answer for each item. When you have completed the exercise, check your answers with the answer key that follows. If you answer any item incorrectly, review that part of the lesson which contains the portion involved.

Situation: Your unit may be attacked with unknown chemical agents. As NBC NCO you must train members to identify and recognize effects of chemical agents.

1. Which is an antidote for nerve agent poisoning?

   ○A. Vesicant.
   ○B. Physostigmine.
   ○C. Atropine.
   ○D. Dessicant.

2. Which agent primarily affects the lungs and respiratory tract?

   ○A. Choking.
   ○B. Nerve.
   ○C. Blood.
   ○D. Blister.

3. Why must you understand each system of marking munitions?

   ○A. Munitions are now manufactured using three systems.
   ○B. New munitions will not be used until the old ones are expended.
   ○C. Current stockpiles contain munitions marked using the three systems.
   ○D. The old system will supersede the current system.

4. Which munitions have a blue background color?

   ○A. Practice.
   ○B. Chemical-filled.
   ○C. Toxic.
   ○D. Incapacitating.

5. What is the definition of a toxin?

   ○A. An agent which acts on the eyes and lungs and blisters the skin.
   ○B. When residual chemical agent clouds drift into position.
   ○C. An alkaloid from Physostigma venonosun.
   ○D. A poisonous product of animal or vegetable cells which will cause illness or death when inhaled or swallowed.

6 How do blood agents affect the body?

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- ○ A. Damage the lungs immediately.
- ○ B. Stop normal metabolism in every cell in the body.
- ○ C. Produce coughing and sneezing.
- ○ D. Cause intense eye pain.

PRACTICE EXERCISE

ANSWER KEY

Situation: Your unit may be attacked with unknown chemical agents. As NBC NCO you must train members to identify and recognize effects of chemical agents.

1. Which is an antidote for nerve agent poisoning?

C. Atropine.

2. Which agent primarily affects the lungs and respiratory tract?

A. Choking.

3. Why must you understand each system of marking munitions?

C. Current stockpiles contain munitions marked using the three systems.

4. Which munitions have a blue background color?

A. Practice.

5. What is the definition of a toxin?

D. A poisonous product of animal or vegetable cells which will cause illness or death when inhaled or swallowed.

6. How do blood agents affect the body?

B. Stop normal metabolism in every cell in the body.

LESSON 2

LETHAL, INCAPACITATING AND MISCELLANEOUS CHEMICAL AGENTS

Critical Tasks: 031-506-2002

OVERVIEW

LESSON DESCRIPTION:

In this lesson you will learn a description of lethal, incapacitating, and miscellaneous chemical agents.

TERMINAL LEARNING OBJECTIVE:

ACTION:	Describe lethal, incapacitating, and miscellaneous chemical agents.
CONDITION:	Given information and illustrations about various chemical agents, including their properties, physiological effects, and uses; the protection required against them; and their detection and decontamination.
STANDARD:	Demonstrate competency of the task skills and knowledge by responding to the multiple-choice test covering various types of chemical agents, including their properties, physiological effects, and uses; the protection required against them; and their detection and decontamination.
REFERENCES:	FM 3-6, FM 3-8, FM 3-9, FM 3-10, and STP 3-54B2-SM.

INTRODUCTION

Nerve agents GB and VX and blister agents, HD, L, and CX are most likely to be used in chemical operations. While there are other nerve and blister agents, these are the most likely to be employed. Nerve agents act on the nervous systems or may interfere with breathing and cause convulsions, paralysis, and death. While different nerve agents differ in molecular structure, all nerve agents have the same physiological action. They cause an increase in acetylcholine throughout the body by interfering with the vital enzyme cholinesterase. In general, the peripheral nervous system of the body makes use of two chemicals to transmit information (impulses). These chemicals allow the nervous system to control voluntary (by choice) and involuntary, such as breathing, body functions. Nerve agents interfere with cholinesterase, which plays a vital role in the control of muscles around the skeleton. Nerve agents permit 'acetylcholine to persist at the muscle junctions with effects of a massive release of acetylcholine, causing an uncontrolled muscle function. The major effects will be on skeletal muscles, the heart, lungs, and central nervous system. See Table 2-4.

PART A - NERVE AND BLISTER AGENTS

1. Nerve agents are highly toxic and among the deadliest of chemical agents. There are two types of nerve agents: the **G-Series and V-Series. G-Series** nerve agents include: Tabun **(GA),** Sarin **(GB),** and Soman, **(GD).** The **V-Series** nerve agents are **VX** and **VY.** Information on VY is limited, and therefore it will not be covered.

   a. **Nerve Agent (VX).** Nerve agent VX is an odorless, amber-colored liquid similar in appearance to motor oil. VX is used as a quick-acting casualty agent. Casualties are produced by inhalation and/or absorption through the skin. VX can be detected with either M8 Detector Paper or the M256 Chemical Agent Detector Kit.

(1) **Detection Using M8 Detector Paper.** Procedures for the detection of nerve agent using M8 Detector Paper are:

Step 1. MASK.

Step 2. Blot, but do not rub, the M8 Paper on the suspected liquid agent. Be careful not to touch the liquid with your gloved hand. You may want to put the paper on the end of a stick or other object, then blot the paper on the liquid agent.

Step 3. Compare the color change with the chart located inside the front cover of the M8 paper booklet. If a V agent such as VX is present, the color indicated will be green or dark green.

NOTE

M8 paper has limitations. It will detect only liquid chemical agents. Some decontaminants and POL products will cause color changes similar to those of chemical agents. As a minimum, the soldier should wear a protective mask and gloves when performing this task.

(2) **Detection Using the M256 Chemical Agent Detector Kit.** Procedures for detection of nerve agent using the M256 Chemical Agent Detector Kit are described in the following steps.

Step 1. MASK.

Step 2. Remove one detector sampler from the kit.

Step 3. Tear protective bag and remove sampler.

Step 4. Perform steps 1 - 12 as described on the protective bag and the kit instruction cards.

Step 5. The nerve agent section of the sampler will remain colorless or turn a peach color if a nerve agent such as VX is present. Any shade of blue indicates the absence of VX.

WARNING

Do not use an outdated sampler because it will give unreliable test indications. As a minimum, you must wear the protective mask and gloves when operating the M256 Chemical Agent Detector.

(3) **Decontamination.** Decontamination of VX can be accomplished by using any of the following decontaminants or decontamination kits: STB slurry, DS2, or hot, soapy water; M258-Series Kit; M280 Decontamination Kit, Individual Equipment; or M291 Skin Decontamination Kit.

b. **Nerve Agent (GA).** Nerve agent Tabun (GA) is a brownish to colorless liquid that gives off a colorless vapor. It enters the body primarily through the respiratory tract, but it is also highly toxic through the skin and digestive tract. It is about 20 times more persistent than GB, but not as stable in storage.

(1) **Detection.** Detection methods for GA can be accomplished by any of the following detection equipment: M8 and M9 Detector Paper; M256A1 Chemical Agent Detection Kit; M8 and M8A1 Chemical Alarms; Chemical Agent Monitor (CAM); and the M18A2 Detector Kit.

(2) **Decontamination.** Decontamination can be accomplished by using bleach slurry, DS-2, steam, ammonia, M258A1 and M291 Skin Decontamination Kits and the M280 Decontamination Kit.

c. **Nerve Agent (GB).** Nerve agent GB is colorless, odorless liquid. In an impure form, it may have a slight fruity odor. GB is used as a quick-acting casualty agent. Casualties are produced by inhalation and/or absorption through the skin. GB can be detected and decontaminated by using the same procedures as described for VX.

d. **Nerve Agent (GD).** Nerve agent Soman (GD) is a colorless liquid that gives off a colorless vapor. It is the most poisonous of the G-Agents. The physiological effect of GD is essentially the same as that of GA and GB. The addition of agent thickeners increases GD persistency and hazard. The usual thickened form of GD is designated TGD. Detection and decontamination of GD are accomplished by using the same procedures as described for GA.

e. **Nerve Agent (GF).** GF is a slightly volatile liquid that is almost insoluble in water. It enters the body primarily through the respiratory tract but is also highly toxic through the skin and digestive tract. Detection and decontamination of GF are accomplished by using the same procedures as described for GA.

2. **Blister Agents.** All of the blister agents are persistent, and all may be employed in the form of colorless gases and liquids. The blister agents are used primarily for casualty effects. They may also be used to restrict use of terrain, slow movements, and hamper use of material and installations. These agents affect the eyes and lungs and blister the skin. During World War I, mustard (HD) was the only blister agent in major use. It was recognized by a distinctive odor and had a fairly long duration of effectiveness under normal weather conditions. Since then, blister agents have been developed which are odorless and vary in duration of effectiveness. Most blister agents are insidious in action there is little or no pain at the time of exposure except with Lewisite(L) and phosgene oxime(CX), which cause immediate pain on contact. The development of casualties is somewhat delayed. CX produces a wheal (similar to a bee sting) rather than a water blister, which the other blister agents produce. Protection from blister agents is extremely difficult.

a. **Blister Agent (HD).** Blister agent HD is a colorless to pale yellow liquid with a garlic-like odor. HD is used as a delayed-action casualty agent. First symptoms usually appear four to six hours after contamination has occurred. The higher the concentration, the shorter the interval of time from the exposure to the first symptoms; however, some individuals have shown first symptoms in time periods ranging from 24 hours to 12 days. HD acts first as a cell irritant and finally as a cell poison on all tissue surfaces contacted.

(1) **Physiological Action of HD.** The physiological action of HD may be classified as local and systemic. The local action results in conjunctivitis or inflammation of the eyes;

erythema (redness of the skin) which may be followed by blistering or ulceration and inflammation of the nose, throat, trachea, bronchi, and lung tissue. Susceptibility also varies with individuals. Injuries produced by HD heal much more slowly and are more liable to infection than burs of similar intensity produced by physical means or by most other chemicals. Systemic effects of mustard may include malaise, vomiting and fever, with the time of onset about the same as that of the skin erythema. With amounts approaching the lethal dose, injury to bone marrow, lymph nodes, and spleen may result. Such damage is reflected in the peripheral blood by a drop in the white blood cells. Because these cells are essential in the body for preventing infections, a significant drop in the white blood cells will cause the mustard casualties to be far more susceptible to local and overwhelming infections than the normal individual.

(2) **Detection Using M8 Detection Paper.** Procedures for detection of HD using M8 Detector Paper are:

Step 1. MASK.

Step 2. Lay a strip of M8 paper on the suspected liquid so that the paper just touches the liquid.

Step 3. Compare the color change with the chart located inside the front cover of the M8 Paper booklet. If a mustard agent such as HD is present, the color indicated will be red or purple.

NOTE

M8 paper has limitations. It will detect only liquid chemical agents. Some decontaminants will cause color changes similar to those of chemical agents.

(3) **Detection Using the M256 Chemical Agent Detector Kit.** Procedures for detection of HD using the M256 Chemical Agent Detector Kit are described in the following steps.

Step 1. MASK.

Step 2. Remove one detector sampler from the kit.

Step 3. Tear the protective bag and remove the sampler.

Step 4. Perform steps 1 - 12 as described on the protective bag and the kit instruction cards.

Step 5. The blister agent section of the sampler will turn purple/blue if HD is present. No color change indicates the absence of HD.

WARNING

Do not use an outdated sampler, because it will give unreliable test indications.

(4) **Decontamination.** Decontamination can be accomplished by using STB, fire, or DS2. Liquid agent on the skin may be decontaminated by use of the M280 or the M291 Skin Decontamination Kit or the new M258A1 Skin Decontamination Kit.

b. **Levinstein Mustard (H).** This is mustard made by the Levinstein process. It contains about 30 percent sulfur impurities, which give it a pronounced odor. The properties of H are essentially the same as those for HD, except that sulfur impurities lessen its effectiveness and depress the freezing point by 2° to 5°.

c. **Blister Agent (L).** Lewisite is a dark oily liquid with a variable odor (sometimes like geraniums). Lewisite is used as a moderately delayed casualty agent and produces effects similar to those produced by HD. It also acts as a systemic poison, causing pulmonary edema, diarrhea restlessness, weakness, subnormal temperature, and low blood pressure. In order of severity and appearance of symptoms, it is a blister agent; a toxic lung irritant; and when absorbed in the tissues, a systemic poison. Liquid L causes an immediate searing sensation in the eye and permanent loss of sight if not decontaminated within 1 minute with large amounts of water. L produces an immediate and strong stinging sensation to the skin; reddening of the skin starts within 30 minutes. Blistering does not appear until about 13 hours. Like HD, L is a cell poison. Skin burns are much deeper than those caused by HD. When inhaled in high concentrations, L may be fatal in as short a time as 10 minutes.

(1) **Detection Using the M256 Chemical Agent Detector Kit.** Procedures for detection of blister agent L using the M256 Chemical Agent Detector Kit are described in the following steps.

Step 1. MASK.

Step 2. Remove one detector sampler from the kit.

Step 3. Tear the protective bag and remove the sampler.

Step 4.. Perform steps 1 - 12 as described on the protective bag and the kit instruction cards

Step 5. Observe the paper tab. A color change to olive green indicates Lewisite is present while a brown or tan color indicates an absence of agent.

WARNING

Do not use an outdated sampler, because it will give unreliable test indications.

(2) **Decontamination.** Decontamination can be accomplished by using STB, DS2, or caustic soda. Liquid agent on the skin may be decontaminated by use of the skin decontamination pad in the M13 Kit or by using the M280, M258A1 or M291 Skin Decontamination Kits.

d. **Mustard-Lewisite Mixture (HL)**. Mustard-lewisite mixture is a variable of HD and L which provides a low-freezing mixture for use in cold weather operations or as high-altitude

spray. Properties are listed for the eutectic mixture (the mixture having the lowest possible freezing point), which is 63 percent L and 37 percent HD by weight. Other mixtures, such as 50-50, may be prepared to meet predetermined weather conditions and have advantages over the eutectic mixture because of the increased HD content.

e. **Blister Agent (CX).** Phosgene oxime may appear as a colorless, low-melting point (crystalline) solid or as a liquid. It is readily soluble in water. CX has a disagreeable, penetrating odor. It is used as a quick-acting casualty agent. CX is a powerful irritant which produces IMMEDIATE pain varying from a mild prickling sensation to a feeling resembling a severe bee sting. It causes violent irritation to the mucous membranes of the eyes and nose. When CX comes in contact with the skin, the area becomes blanched in 30 seconds and is surrounded by a red ring. A wheal forms in about 30 minutes and the blanched area turns brown in about 24 hours, with a scab forming in about a week. The scab generally falls off in about three weeks. Itching may be present throughout healing which, in some cases, may be delayed beyond two months.

(1) **Detection Using the M256 Chemical Agent Detector Kit.** Procedures for detection of phosgene oxime using the M256 Chemical Agent Detector Kit are described in the following steps.

Step 1. MASK.

Step 2. Remove one detector sampler from the kit.

Step 3. Tear the protective bag and remove the sampler.

Step 4. Perform steps 1 -12 as described on the protective bag and the kit instruction cards.

Step 5. Observe the color change on the blister agent section of the sampler. A red/purple color change indicates CX is present (colorless is safe).

WARNING

Do not use an outdated sampler, because it will give unreliable test indications.

(2) **Decontamination.** Because of the rapid reaction of CX with the skin, decontamination will not be entirely effective after pain occurs. Nevertheless, decontamination should be accomplished as rapidly as possible by flushing the area with large amounts of water to remove any agent that has not reacted with the skin.

3. Persistent agents are employed over terrain that friendly forces do not plan to use or against rear targets for disruption or interdiction.

Nonpersistent agents are employed against unprotected enemy troops occupying terrain that friendly forces plan to cross or occupy. A nonpersistent agent should be used to avoid creating a residual hazard. A nonpersistent agent is used as a vapor or aerosol to cause casualties. A nonpersistent agent is used to force troops to assume and maintain a protective posture and to degrade combat efficiency. Unprotected

troops, those not wearing masks at the time of the attack, are immediate casualties. All nonpersistent agents produce immediate casualties.

Table 2-1 provides a list of persistent and nonpersistent chemical agents.

	Persistent	Nonpersistent
Nerve	VX	GA/Tabun
	GD/Soman	GB/Sarin
Blister	HD/Distilled Mustard	
	HH/Nitrogen Mustard	
	L/Lewisite	
	HL/Mustard	
	Lewisite	
	CX/Phosgene	
	Oxime	

Table 2-1. Chemical Agents

PART B - BLOOD AND CHOKING AGENTS

1. Blood and choking agents primarily enter the body through the respiratory system. These agent are nonpersistent agents. They are normally effective only against personnel not wearing protective masks and clothing. The standard protective mask gives adequate protection against field concentrations of blood agents. Impermeable protective clothing and the mask is needed when liquid AC is handled. Blood agents produce their effects by interfering with normal utilization of oxygen within the body. Inhalation is the usual route of entry. Hydrogen cyanide (AC) and cyanogen chloride (CK) are the important agents in this group. Cyanogen chloride also acts as a choking agent. These agents can be dispersed by artillery or mortar shells, rockets, aircraft spray, and bombs.

a. **Blood Agent (AC).** Blood agent AC (Hydrogen Cyanide) is a colorless, highly volatile liquid. It is highly soluble and stable in water. It has a faint odor, like peach kernels or bitter almonds, and sometimes cannot be detected even in lethal concentrations. AC is less persistent than other blood agents. The central nervous system, particularly the respiratory center, is especially susceptible to AC, and respiratory failure is the usual cause of death. In high concentrations, the amount of AC inhaled in a few breaths may be enough to cause immediate death without anatomical changes. After exposure to lower concentrations, there may be small areas of hemorrhage and softening in the brain which are more pronounced in delayed deaths. Death from AC leaves the blood well oxygenated and the skin has a pink color similar to that seen in carbon monoxide poisoning.

(1) **Detection Using the M256 Chemical Agent Detector Kit.** AC is used as a quick-acting casualty agent and can be detected by using the M256 Chemical Agent Detector Kit. Procedures for detection using the kit are described in the following steps.

Step 1. MASK.

Step 2. Remove one detector sampler from the kit.

Step 3. Tear the protective bag and remove the sampler.

Step 4. Perform steps 1 -12 as described on the protective bag and the kit instruction cards.

Step 5. The blood agent section of the sampler will turn pink or blue if a blood agent is present. (Colorless or tan is safe).

WARNING

Do not use an outdated sampler, because it will give unreliable test indications.

(2) **Decontamination.** Decontamination is not required under field conditions.

b. **Blood Agent (CK).** Blood agent CK (Cyanogen Chloride) is a colorless, highly volatile liquid. Although only slightly soluble in water, it dissolves readily in organic solvents. Its vapor, heavier than air, is very irritating to the eyes and mucous membrane surfaces. CK's pungent biting odor is masked by its irritating and lacrimatory properties. Normally CK is nonpersistent.

CK is a quick-acting casualty agent. It also causes degradation of canisters of filter elements in protective masks. This makes an individual more vulnerable to a subsequent lethal agent attack. CK acts in two ways. Its systemic effects are similar to those of AC, but it also has local irritant effects on the eyes, upper respiratory tract and lungs. CK damages the respiratory tract resulting in severe inflammatory changes in the bronchioles, and congestion and edema in the lungs. The fluid in the lungs may accumulate much faster than in phosgene poisoning. All concentrations of CK produce eye irritation and lacrimation. CK can be detected by the same methods as those for AC. In addition, decontamination is not required under field conditions.

2. **Choking Agents.** Chemical agents which attack lung tissue, primarily causing pulmonary edema, are classified as choking agents. Best known of these agents is phosgene. Agents in this class are called choking agents because irritation of the bronchi, trachea, larynx, pharynx, and nose may occur and, with pulmonary edema contribute to the sensation of choking. Blister agents and certain systemic agents also may injure the respiratory tract. Since the action of phosgene is typical of the choking agents, it is used as the example in this part of the lesson. Persons exposed to phosgene need not be withdrawn during combat unless signs of pulmonary distress appear. The medical officer should advise the responsible commanding officer.

a. **Choking Agent (CG).** At ordinary temperatures and atmospheric pressure, phosgene is a colorless gas. It has an odor resembling that of new-mown hay, grass, or green corn. It is readily condensed by pressure or lower temperature to a colorless liquid which boils at 46°F. (8°C.). Phosgene reacts rapidly with water to yield nontoxic hydrolysis products. Its concentration in air is reduced by water condensates (rain, fog) and by dense vegetation. It is known as a nonpersistent chemical agent which exerts its effects solely on the lungs, and results in damage to the capillaries and scarring of the lungs. It causes seepage of watery fluid into the air sacs. When a lethal amount of CG is received, the air sacs become so flooded that air is excluded and the victim dies of anoxia (oxygen deficiency). The severity of poisoning cannot be estimated

from the immediate symptoms, since the full effect is not usually apparent until 3 or 4 hours after exposure. Most deaths occur within 24 hours.

CG is used as a delayed-action casualty-producing agent although immediate symptoms may follow exposure to high concentrations of CG. A standard field protective mask or a gas-particulate filter unit (collective protector) gives adequate protection against choking agents. Detection of phosgene prior to contamination can be accomplished by using the M8 or M18A2 Automatic Chemical Agent Alarm System and odor. Decontamination is not required under field conditions.

NOTE

The M8 Automatic Chemical Agent Alarm System will detect only blood, nerve, and choking agents.

b. **Choking Agent (DP).** Choking agent DP (Diphosgene) has a much higher boiling point than CG. DP is slightly lacrimatory, therefore, DP has less surprise value than CG when used on troops. Furthermore, its lower volatility adds to the difficulty of setting up an effective surprise concentration. DP is converted to CG in the body and exerts its effect after this conversion. DP is unstable in storage because of conversion to CG. All other considerations remain the same as phosgene.

3. Both blood and choking agents are nonpersistent agents. This allows friendly troops to occupy an area after the agents have been used. Since they are used as vapors or aerosols, they tend to evaporate quickly, leaving little residual hazard.

Table 2-2 provides a list of blood and choking agents which are nonpersistent.

Blood	AC/Hydrogen Cyanide CK/Cyanogen Chloride
Choking	CG/Phosgene DP/Diphosgene

Table 2-2. Nonpersistent Agents

PART C - MISCELLANEOUS AND INCAPACITATING AGENTS

1. Incapacitating chemical munitions are employed on selected targets to incapacitate enemy forces when the use of lethal or destructive munitions is undesirable. They are normally used to accomplish the following. See Table 2-1.

- Incapacitating chemical attacks are made against hard targets, such as fortifications, to obtain delayed and relatively long-term neutralization of personnel. This will permit delayed exploitation or capture by friendly forces when the stage of battle permits, if the initial attack is made at long range. Such an attack can assist in the rescue of friendly personnel imprisoned in the fortifications.

- Incapacitating chemical attacks can be made to reduce overall fighting capability of intermingled enemy and friendly military units when the location of these units is not well known. This will permit the identification, delayed selective followup, and physical separation of friendly military units intermingled with enemy units without incurring heavy casualties among friendly troops.
- Incapacitating chemical attacks can be made to reduce the overall capability of intermingled enemy, captured friendly, and civilian personnel in an area. This will permit delayed selective followup and physical separation of personnel by friendly forces without incurring heavy civilian (or captured) friendly casualties.
- Incapacitating chemical attacks can be made against selected targets to assist in the capture of vital or sensitive enemy installations for intelligence purposes or to interfere with enemy use of such installations.

2. An incapacitating agent is an agent producing physiological or mental effects that may persist for hours or days after exposure to the agent has ceased In actual usage, however, the term refers to those agents which:

- Produce their effects mainly by altering or disrupting the higher regulatory activity of the central nervous system.
- Have effects which last a significant period of time, rather than momentary or fleeting action.
- Do not seriously endanger life except at quantities greatly exceeding the effective dose, and produce no permanent injury.
- An individual will recover without treatment and without any permanent effects.
- Are highly potent and logistically feasible.

3. Incapacitating agents DO NOT include the following:

- Lethal agents which are incapacitating as sublethal doses, such as the nerve agents.
- Substances which cause permanent or long-lasting injury, such as blister agents, choking agents, and those causing eye injury.
- Medical drugs which exert marked effects on the central nervous system, such as belladonna alkaloids, barbiturates, tranquilizers, and many of the hallucinogens. These drugs, although effective and relatively safe, are logistically infeasible for large-scale use because of the high doses required.
- Agents of temporary effectiveness which produce reflex responses interfering with performance of duty. These include skin and eye irritants causing pain or itching (vesicants or urticants), vomiting or cough-producing compounds (sternutators), and tear compounds (lacrimators).
- Agents which disrupt basic life-sustaining systems of the body and thus prevent the carrying out of physical activity. Examples include agents which lower blood pressure, paralyzing agents such as curare, fever-producing agents, respiratory depressants, and blood poisons. Although

theoretically effective, such agents almost invariably have a low margin of safety between the effective doses and the possibly lethal doses and thus affect the basic purpose of an incapacitating agent, which is to reduce military effectiveness without endangering life.

4. **General Types.** In spite of the restrictions imposed by the above definition, a great variety of mechanisms remain by which central nervous system regulation and maintenance of performance could theoretically be disrupted. In reality, however, only two general types of incapacitating chemical agents are likely to be encountered in military use. These are central nervous system depressants and central nervous system stimulants.

a. **Central Nervous System Depressants.** Central nervous system depressants are compounds that have the predominant effect of depressing or blocking the activity of the central nervous system, often by interfering with the transmission of information across synapses. An example of this type of agent is BZ, which appears to block the action of acetylcholine both peripherally and centrally in the same way that Atropine does. BZ, however, has far greater relative potency than Atropine with respect to the central nervous system where it disturbs the higher integrative functions of memory, problem-solving, attention and comprehension. High doses produce toxic delirium, which completely destroys the ability to perform any military task. General symptoms from agent BZ are interference with ordinary activity, dry, flushed skin; fast heartbeat; urinary retention; constipation; slowing of mental and physical activity; headache; giddiness; disorientation and hallucinations.

Cannabinols (marijuana) and phenothiazine type compounds are other potential incapacitating agents which seem to act basically as central nervous system depressants. Euphoria, a relaxed, unconcerned daydreaming attitude, easy laughter, hypotension and dizziness when standing up suddenly are signs and symptoms of marihuana use. The primary effects of these agents, however, are to sedate and destroy motivation rather than disrupt the ability to think.

b. **Central Nervous System Stimulants.** Central nervous system stimulants are agents that cause excessive nervous activity, often by "boosting" or facilitating transmission of impulses that might otherwise be insufficient to cross certain synapses. The effect is to "flood" the brain with too much information, making concentration difficult and causing indecisiveness and inability to act in a sustained, purposeful manner. A well known drug which appears to act in this manner is d-lysergic acid diethylamide (LSD); similar effects are sometimes produced by large quantities of the amphetamines. Detection of these agents is difficult. Supervisors must rely mainly on visual observation of soldiers. Field laboratory methods are not yet sufficiently developed to permit isolation and identification of specific agents in samples of body fluid (e.g., blood, urine, cerebrospinal fluid). Diagnosis depends almost entirely upon clinical judgment combined with whatever field intelligence or detector system data may be available.

The officer/NCO in charge should be prepared to take the following steps after the occurrence of a suspected chemical attack with incapacitating agents.

Step 1. Instruct field-evacuation teams to transport casualties to an uncontaminated area. Resistant or disoriented individuals should be restrained on a litter or tied to a fixed object after taking the

necessary steps to administer first aid.

Step 2. Once the detection of nerve agent or other lethal Substance has been ruled out, the principal signs and symptoms to consider are given in Table 2-3.

NOTE

Although these signs and symptoms can appear from an agent family, they may also appear from an anxiety reaction.

Step 3. In the case of a large-scale attack the diagnosis will be simplified by the recognition of symptoms and the distribution of casualties. It is better to look for characteristics common to all or most casualties than to be overly impressed with a typical features. For example, some anticholinergics may cause marked disorientation, incoherence, hallucinations, and confusion (the distinctive features of delirium) with very little, if any, evidence of effects on the central nervous system (such as fast heartbeat and dilated pupils). This should not exclude the possibility of a centrally predominant anticholinergic being the causative agent since very few other drugs can produce delirium in militarily feasible doses. The disturbance produced by indoles (such as LSD) or marihuana is not really delirium because the individual remains receptive to the environment and can comprehend quite well, even though they may have great difficulty in reacting appropriately.

(See Table 2-4).

5. **Decontamination.** The skin should be completely cleansed with soap and water at the earliest opportunity. The M258A1 Kit can be used if washing is impossible. Symptoms may appear as late as 36 hours after contact exposure, even if the skin is washed within an hour. In fact a delay in onset of several hours is typical. This time should be used to prepare for the possibility of a widespread outbreak 6-24 hours after the attack. Caustic alcohol solutions can be used to decontaminate bulk quantities of BZ.

Table 2-3. Incapacitating Agent Signs and Symptoms

SIGNS AND SYMPTOMS	POSSIBLE AGENT FAMILY
Restlessness, dizziness, or giddiness; failure to obey orders, confusion; erratic behavior; stumbling or staggering; vomiting. See NOTE on previous page.	Anticholinergic (e.g., BZ). Indoles (e.g., LSD). Cannabinols (e.g., marihuana). Other intoxications (e.g., Alcohol, bromides, lead, Barbiturates, etc.).
Dryness of mouth, tachycardia at rest; elevated temperature flushed face; blurred vision; pupils dilated; slurred or nonsensical speech; stupor and coma; hallucinatory behavior; disrobing; mumbling and picking behavior	Anticholinergics (BZ)
Inappropriate smiling or laughing; irrational fear; distractability; difficulty in expressing self; labile increase in pupil size, heart rate and blood pressure perceptual distortions; stomach cramps and vomiting may occur.	Indoles (Schizophrenic psychosis may mimic in some respects.)
Euphoric, relaxed, easy laughter; unconcerned day-dreaming attitude; dizziness and hypotension when standing suddenly.	Cannabinols
Tremor, clinging, or pleading crying; decrease in disturbance with reassurance; history of nervousness or immaturity; phobias.	Anxiety reaction See NOTE on previous page.

Table 2-4. Chemical Agents

TYPE OF AGENT	SYMBOL	DETECTION EQUIPMENT	SYMPTOMS	EFFECTS	RATE OF ACTION
NERVE	GA GB GD	M256 M256A1 M18A2 M19 M8/M9 PAPER M8A1 ALARM M272 CAM Chemical Agent Monitor	Difficult breathing; sweating; drooling; nausea; vomiting; convulsions dim vision. Loss of bowel bladder control; jerking twitching, staggering; headache, confusion, drowsiness and coma.	Low concentrations incapacitate. Kills if inhaled or absorbed through the skin.	Very rapid by inhalation. Slower through the skin
	V			Incapacitates; kills if contaminated skin is not decontaminated soon	Delayed through the skin Rapid through the eyes

HOW NORMALLY DISSEMINATED	PROTECTION REQUIRED	PERSISTENCY			DECONTAMINATION
		Agent/Amt	Temp	Days	
Aerosol or vapor	Protective mask and clothing	GD	Hot	.08-0.5	STB slurry, household bleach, 10% solution of lye or washing soda steam and ammonia in confined area, hot soapy water, M258 Kit DS2, M280 and M291 Decon Kits
		Moderate	Warm	0.1-0.8	
			Mild	0.5-1.0	
			Cold	2.0-4.0	
			V.Cold	4.0-12	
Liquid or Droplets	Protective mask and clothing	V	Hot	4.0-12	
		Moderate	Warm	12-24	
			Mild	24-72	
			Cold	48-144	
			V.Cold	168-336	

TYPE OF AGENT	SYMBOL	DETECTION EQUIPMENT	SYMPTOMS	EFFECTS	RATE OF ACTION
BLOOD	AC CK	M256 M256A1 M18A2 M19 M272	Rapid breathing; convulsion; coma; death	Incapacitates; kills if high concentration is inhaled	Rapid

HOW NORMALLY DISSEMINATED	PROTECTION REQUIRED	PERSISTENCY	DECONTAMINATION
		Agent/Amt Temp Days	
Aerosol or vapor	Protective mask	Short Duration (5-10 minutes)	None needed in field

TYPE OF AGENT	SYMBOL	DETECTION EQUIPMENT	SYMPTOMS	EFFECTS	RATE OF ACTION
BLISTER	HD HN L HL CX	M256 M256A1 M272 M18A2 M19 M8/M9 Paper CAM (H-Series)	Mustard; nitrogen mustard, no early symptoms. Lewisite and mustard searing of eyes and stinging of skin. Phosgene oxime, irritation of eyes, nose and skin.	Blisters skin and respiratory tract; can cause temporary blindness; some agents sting and form wheals on skin.	Blisters delayed hours to days; eye effects more rapid. Mustard lewisite and phosgene oxime very rapid.

HOW NORMALLY DISSEMINATED	PROTECTION REQUIRED	PERSISTENCY	DECONTAMINATION
		Agent/Amt Temp Days	
Liquid or Droplets	Protective mask and protective clothing	HD Hot 1-3 Moderate Warm 2-6 Mild 6-24 Cold 12-36 V Cold 48-140	STB, DS2, household bleach M258 Kit, lye, fire, wash with soap and water. M280 and M291 Decon Kits
		HD Hot 4-8 Heavy Warm 12-24 Mild 24-48 Cold 72-168 V Cold 168-4032	

TYPE OF AGENT	SYMBOL	DETECTION EQUIPMENT	SYMPTOMS	EFFECTS	RATE OF ACTION
INCAPA-CITANT	None is known; a sleep inducer was reported in Afghani-stan.	Unknown	Slowing mental and physical disorienta-tion and sleep.	Temporary incapaci-tation.	Unknown

HOW NORMALLY DISSEMINATED	PROTECTION REQUIRED	PERSISTENCY	DECONTAMINATION
		Agent/Amt Temp Days	
Aerosol or Vapor	Protective Mask	Unknown	Unknown

TYPE OF AGENT	SYMBOL	DETECTION EQUIPMENT	SYMPTOMS	EFFECTS	RATE OF ACTION
IRRITANT	DA DM CN CS PS	M19	Causes tears, irritates skin and respiratory tract.	Incapa-citates, nonlethal.	Very rapid.

HOW NORMALLY DISSEMINATED	PROTECTION REQUIRED	PERSISTENCY	DECONTAMINATION
		Agent/Amt Temp Days	
Aerosol	Protective Mask	Relatively Short	Aerosol in open Sodium carbonate solution. Alcohol sodium hydroxide mixture. DKIE, HTH, DS2.

LESSON 2
PRACTICE EXERCISE

Instructions The following items will test your understanding of the material covered in this lesson. There is only one correct answer for each item. When you have completed the exercise, check your answers with the answer key that follows. If you answer any item incorrectly, review that part of the lesson which contains the portion involved.

Situation: In order to prepare your unit to recognize chemical agents, uses, and decontamination of lethal, incapacitating, and miscellaneous chemical agents, you must be knowledgeable and well-informed.

1. Which agent would stimulate the central nervous system?

- ○A. Atropine
- ○B. BZ
- ○C. LSD
- ○D. Marihuana

2. Which will the Automatic Chemical Agent Alarm System detect?

- ○A. Phosgene
- ○B. Lewisite (L)
- ○C. HD
- ○D. CS

3. Which is a quick-acting casualty agent similar in appearance to motor oil?

- ○A. CX
- ○B. L
- ○C. HD
- ○D. VX

4. What color would indicate the presence of an agent in the blood agent section of the sampler?

- ○A. Blue
- ○B. Green
- ○C. Tan
- ○D. White

5. Which could blurred vision, pupil dilation, and slurred speech indicate?

- ○A. FS
- ○B. BZ
- ○C. Indoles
- ○D. Lead poisoning

6 Which concentration could cause injury to bone marrow?

.

- A. CX
- B. L
- C. HD
- D. VX

PRACTICE EXERCISE

ANSWER KEY

Situation: In order to prepare your unit to recognize chemical agents, uses, and decontamination of lethal, incapacitating, and miscellaneous chemical agents, you must be knowledgeable and well-informed.

1. Which agent would stimulate the central nervous system?

C. LSD

2. Which will the Automatic Chemical Agent Alarm System detect?

A. Phosgene

3. Which is a quick-acting casualty agent similar in appearance to motor oil?

D. VX

4. What color would indicate the presence of an agent in the blood agent section of the sampler?

A. Blue

5. Which could blurred vision, pupil dilation, and slurred speech indicate?

B. BZ

6. Which concentration could cause injury to bone marrow?

C. HD